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Evaluating Metropolitan Assembly Web Sites in Ghana: Accessibility, Compatibility and Usability

Ebenezer Agbozo
Ural Federal University, Yekaterinburg, Russian Federation. E-mail: eagbozo@urfu.ru

Kamen Spassov
Ph.D., Associate Professor, Sofia University "St. Kliment Ohridski", Sofia, Bulgaria.
E-mail: kspasov@fmi.uni-sofia.bg

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Abstract

In recent years, metropolitan assemblies in Ghana have undergone population increase due to urbanization (rural-urban migration). As a conduit for engaging residents, local governments all over the world are leveraging on web sites to provide e-services for citizens and residents so as to establish communication, trust and accountability. Quality web sites are crucial in user retention and user participation. Using Web Content Accessibility Guidelines (WCAG) heuristics and the W3C (World Wide Web Consortium) standards, this paper analyses content professionalism and public outreach of the web sites of four out of Ghana's six metropolitan assemblies. The study evaluates the selected web sites by utilizing an automated web testing technique, mobile-friendliness and usability test, and content observation technique. The study proposes a Double Evaluation Technique (DET) for assessing web sites. The study uncovers shortcomings with regards to non-compliance to international web standards. Finally results, practical implications and recommendations are discussed. The results of this study contain implications for e-government stakeholders, precisely government web designers and developers. Ultimately, the study emphasizes on the need for policymakers at the metropolitan level to encourage frequent web site evaluation so as to be up to date with the fast changing web landscape.

Keywords

Double evaluation technique; Ghana; Metropolitan; Automated evaluation tools; Web site accessibility; Web site usability; e-Government; Heuristics

Introduction

The internet is reshaping government through improved public services (Pretorius, 2017) and as such governments all over the world are embracing this paradigm of Electronic Government (e-Government) (Agbozo, 2017; Pappel et al., 2017; Serguieva, & Spassov, 2008). Just like every other developing economy, Ghana, in recent years has taken certain strides in its e-Government initiatives and according to the United Nation's e-Government survey for 2014, despite the economic situations, Ghana amongst other similar nations have clearly advanced in their e-government (Nations, 2014).

Aside the provision of e-Government services at the national level, it pertinent that governments also provide a channel at the local level (province, district, region, metropolitan or municipality) which keeps residents informed and serves as a medium for communication which leads to development. According to Srivastava and Teo (2007), government web sites aim at transforming service delivery and ensure an easier and a more convenient interaction between citizens and businesses with the government.

Within a decade – beginning from 2005 and 2015, the number of internet subscribers in Ghana increased exponentially from 1.8 percent to 23.5 percent. Though a digital divide still exists (Quaicoe & Pata, 2015), it indicates a strong presence of the information superhighway and its necessity in the Ghanaian ecosystem. As such, the need for accessibility and usability in government web sites is explained by Armstrong (2011) as follows, "smaller communities with a stronger focus on public accessibility and site mechanics may be deemed more transparent than large communities with a different focus". As indicated by Pretorius (2017), government web sites that do not meet the needs and requirements of its users increase user frustration as well as difficulty and complexity in successfully completing tasks. In assessing federal government web sites in Pakistan, Arfeen et al (2017) concluded on the following attributes which ran across many government web sites: weak innovation capacity and low technology intensity, citizens and users are not satisfied and the lack of provincial/local language variants of the web sites.

Government Web sites: The Relevance of Accessibility, Compatibility, User-Friendliness and Citizen-Centric Designs

In order to achieve the status of an agile government, which is enshrined in the following characteristics; quality of services, trust in institutions and achievement of social outcomes (Soe & Drechsler, 2017), web sites at all levels of government must be user-friendly, accessible. User experience design at the public sector level requires balancing the human needs and interaction design and regarding human-computer interaction (HCI) which is the end-to-end experience of the interaction that the citizen has with systems (web sites), usability, usefulness and the level of satisfaction are the interaction patterns of the service delivery (Pyarelal, & Das, 2017).

In an empirical study on e- Government services web site compliance to WCAG 2.0 standards in Saudi Arabia, Al-Faries et al. (2013) highlighted the need for government web developers and designers to be circumspect in e-service forms so as to prevent low patronage by citizens resulting from frustration.

Web site accessibility, compatibility and usability standards developed by the World Wide Web Consortium (W3C) till date have been adopted by numerous countries (Brewer, 2004). The W3C regulates adherence to Web Content Accessibility Guidelines (WCAG) and Section 508 guidelines by web sites. Created by W3C, the core objective of WCAG is, "providing a single shared standard for web content accessibility that meets the needs of individuals, organizations, and governments internationally" (WCAG, n.d.). The WCAG feature heavily in national laws and standards in some developed economies such as Australia, Canada, European Union (EU), Japan, United Kingdom (UK) and the United States (US) and vary uniquely from each other (Yang & Chen, 2015). In some of the countries mentioned, the implications regarding non-compliance are not fully outlined but on a large scale adoption has been positive.

To investigate this issue, this study examines the following research question: *Are Ghanaian Metropolitan Assembly web sites accessible, compatible, usable, mobile-friendly and citizen-centered?*

The rest of the study follows the following structure; the research methodology, results, discussions and recommendations, and conclusion. In the next section, I describe the methods used in assessing the metropolitan assembly web sites in Ghana.

Data and Evaluation Method

To answer the research question, the study adopted the use of automated web testing tools; SortSite (W3C, n.d.) and WebAIM WAVE (WebAIM, n.d.) for a web-based test for accessibility, compatibility and usability. The automated testing technique "examines source code of web pages to derive adherence to universally accepted stylistic and objective guidelines" and this method was chosen due to its ability to evaluate and identify potential usability issues as well as measuring the level of adherence to the desired web standards (De Marsico & Levialdi, 2004).

Also, for assessing the web sites, Safari 11.0.2 and Google Chrome 63.0.3239.132 browsers on an Apple computer running OSX 10.13.2, with the browser resolution set to 1024 × 768. The mobile friendly and responsiveness of the web sites was tested using Google's Mobile Friendly Test Tool which detects mobile-usability errors.

With respect to the SortSite web site testing tool, the following standard priorities are essential yardstick for measuring the necessary basic requirements a standard web site must possess. It entails standard priorities set up by the Web Content Accessibility Guidelines (WCAG). The

guidelines listed in Table 1 below are the three different levels to which web sites conform to based on the analysis results – A (lowest), AA (midrange), and AAA (highest) (Yang & Chen, 2015).

The analysis of web site pages to unearth issues was performed on the basis of the following attributes:

- ***Overall Quality*** – the comprehensive rating of content presentation on the web site,
- ***Errors*** – evaluation of broken links and spelling errors,
- ***Accessibility*** – evaluation of file types using WCAG and Section 508 guidelines,
- ***Compatibility*** – assesses non-functional HTML, script and image formats in common browsers,
- ***Privacy*** – evaluates web pages' compliance and non-violation of the EU Privacy and Electronic Communications Regulations 2003 and US CAN-SPAM Act 2003,
- ***Search*** – evaluates search engine optimization of web site using Google and Bing webmaster guidelines,
- ***Standards*** – validates web pages according to W3C's HTML and CSS markup guidelines,
- ***Usability*** – assesses web pages against the Usability.gov guidelines.

Table 1. Web content accessibility guidelines (WCAG) Priority (Chisholm et al., 1999)

Priority	Description
A (Priority 1)	A web content developer must satisfy this checkpoint. Satisfying this checkpoint is a basic requirement for some groups to be able to use web documents.
AA (Priority 2)	A web content developer should satisfy this checkpoint. Satisfying this checkpoint will remove significant barriers to accessing web documents.
AAA (Priority 3)	A web content developer may address this checkpoint. Satisfying this checkpoint will improve access to web documents.

As seen in Table 1, the Web Content Accessibility Guidelines are also made use of in the evaluation of the metropolitan web sites listed in Table 2.

Table 2. Metropolitan Assemblies and Ghana and their Official Web sites

Metropolitan	Abbreviation	Official Web site
Kumasi	KMA	http://www.kma.gov.gh/kma/
Accra	AMA	https://ama.gov.gh/
Tema	TMA	http://www.tma.gov.gh/ *(Under Construction)*
Cape Coast	CMA	-
Tamale	TaMA	http://www.tamalemetro.gov.gh/
Sekondi/Takoradi	STMA	http://www.stma.gov.gh/stma/

From Table 2, the list of metropolitan assemblies in Ghana are indicated, but for the purpose of this study, only four out of the six could be analyzed since Cape Coast Metropolitan Assembly's web site is non-existent and that of Tema is under construction at the time of this study.

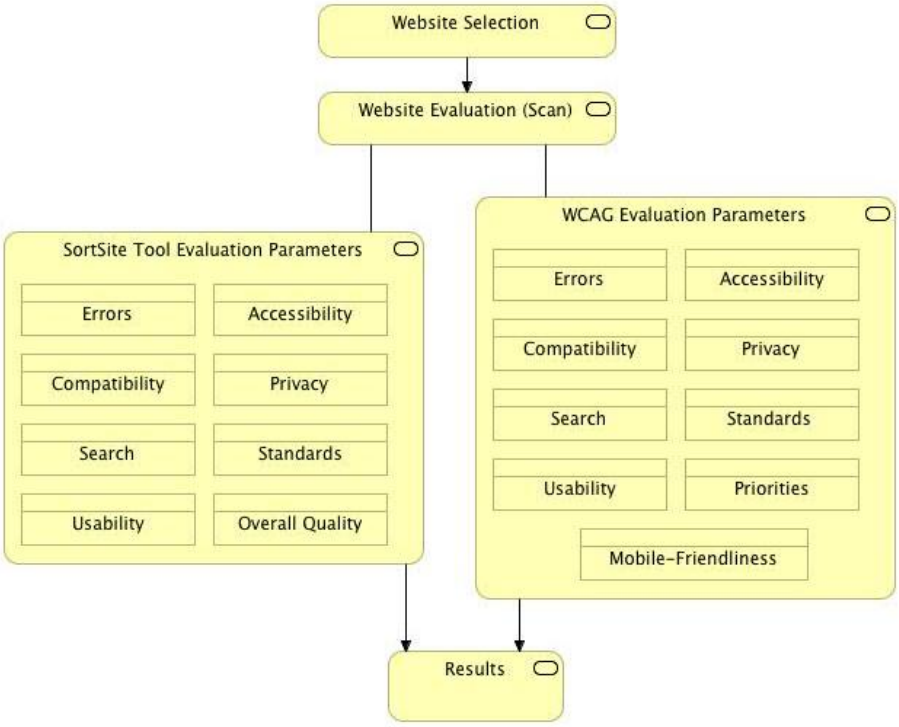

Figure 1. Proposed research model - Double Evaluation Technique (DET) - for assessing web sites

Figure 1 illustrates the evaluation procedure employed for this study. The use of this Double Evaluation Technique is to provide more reliability and a comprehensive overview on web sites to be analyzed in order for both mechanisms to complement each other where parameter details may be deficient. The next section examines results obtained from the evaluation process.

Results

Of all the six metropolitan assemblies, only four have their web sites actively running, one is non-existent and the other is undergoing construction. Upon scanning 100 pages and each resource associated with the page for each of the four municipal assembly web sites, results revealed a pattern which ran through all web sites. As seen in figures 2, 3, 4 and 5:

- the issue of compatibility with respect to browser specific issues was minimal,
- all pages had broken links between two (2) to 44 percent of their pages.
- Three (3) out of the four (4) web sites had over 50 percent pages with issues of quality,
- Three (3) out of the four (4) web sites had 50 percent of their pages with accessibility issues,
- Three (3) out of the four (4) web sites had 50 percent of their pages with usability issues,
- Three (3) out of the four (4) web sites had 50 percent of their pages with privacy issues (compliance or legal issues),
- Three (3) out of the four (4) web sites had 50 percent of their pages with search engine issues, and
- Three (3) out of the four (4) web sites had 50 percent of their pages with W3C standards issues.

In summary, only one out of the four pages, the STMA web site, performed better based on the analytical results. This presents quite a disturbing reality which must be dealt with and raises topics of design and systems analysis which must be addressed. Observations made on the web sites indicated that there were no provisions made for visually impaired users, hence inaccessible and unusable by persons who fall within that class.

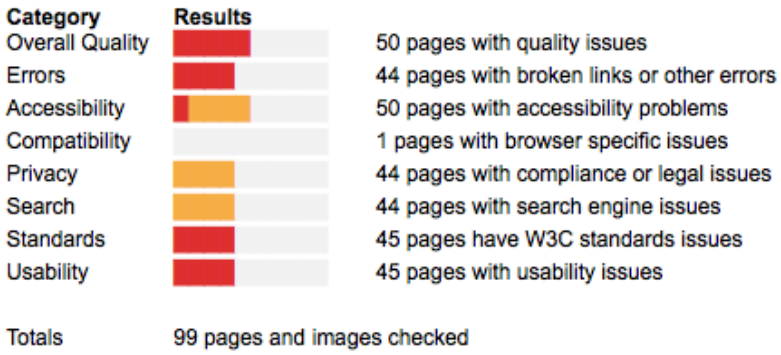

Figure 2. Summary of web site scan for AMA web site

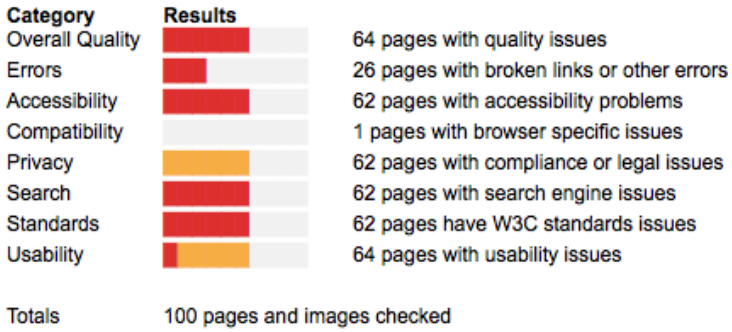

Figure 3. Summary of web site scan for KMA web site

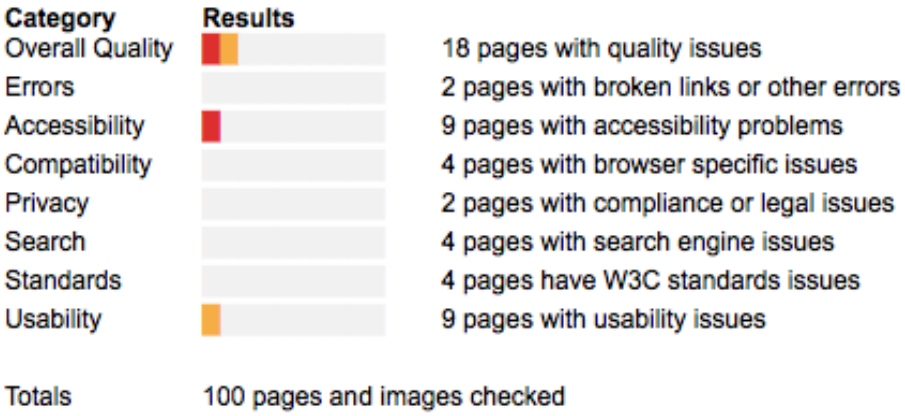

Figure 4. Summary of web site scan for STMA web site

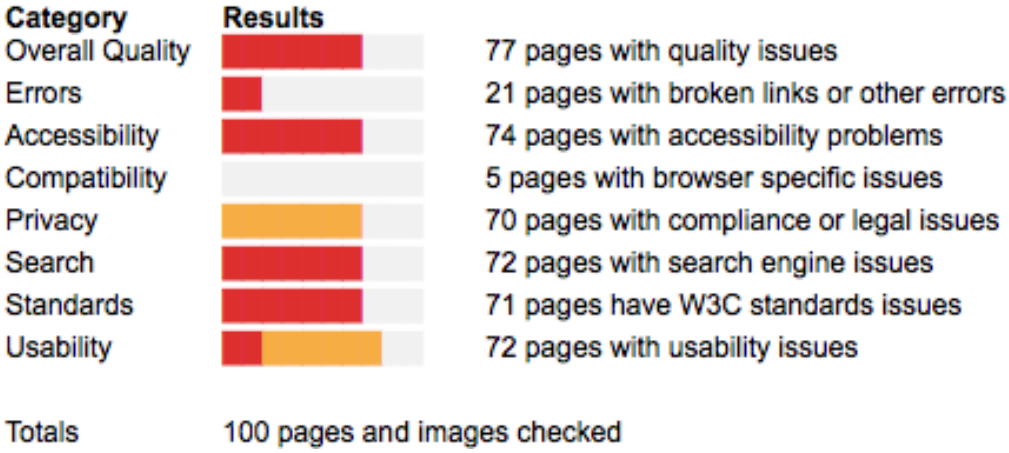

Figure 5. Summary of web site scan for TaMA web site

Figures 2-5 graphically illustrates the level of accessibility, privacy, usability, overall quality, W3C standards compliance, broken links and compatibility of the four metropolitan assembly web sites which were analyzed during this study. Figure 2 indicates the test results of 99 pages and images of the AMA website. Figure 3 illustrates the test results of 100 pages and images of the KMA website. Figure 4 illustrates the test results of 100 pages and images of the STMA

website. Figure 5 presents the test results of 100 pages and images of the AMA website. Results from figures 2-5 are indicative of flaws present in all metropolitan assembly web sites tested.

Furthermore, for the purpose of this study, the following symbols are used to provide insight in the tables represented below:

- "√" :– answers 'yes' to any feature in question.
- "–" :– answers 'no' to any feature in question.

Table 3. Breakdown of Errors across the Metropolitan Assembly Web sites

		AMA	KMA	STMA	TaMA
Errors	Broken links - Some pages contain links that do not work	√	√	√	√
	Server configuration	No issues found	No issues found	√	No issues found
	ASP, ASP.NET and PHP script errors	No issues found	No issues found	No issues found	No issues found
	Internet RFCs	No issues found	No issues found	No issues found	No issues found

Table 4. Breakdown of WCAG standards adherence across the Metropolitan Assembly Web sites

		AMA	KMA	STMA	TaMA
Priorities	Priority A	15 issues on 11 pages	20 issues on 7 pages	20 issues on 62 pages	17 issues on 71 pages
	Priority AA	7 issues on 48 pages	10 issues on 8 pages	11 issues on 62 pages	13 issues on 74 pages
	Priority AAA	1 issue on 1 page	2 issues on 2 pages	1 issue on 1 page	2 issues on 3 pages

Table 3 outlines the breakdown of errors encountered upon analyzing the metropolitan assembly web sites. The presence of broken hyperlinks in all four web sites is overt and as asserted by Marques (2017), broken links cause user frustration. With respect to server configuration issues, only STMA's web site was flagged. Also, none of the web sites had server-side scripting issues. Finally, concerning Request for Comments (RFC), all web sites were complaint as per specifications of the Internet Engineering Task Force (IETF).

Table 4 presents the number of issues per page detected in relation to adherence to WCAG standards. Table 5 displays issues detected upon performing an accessibility analysis on each website as per WCAG standards.

Table 5. Breakdown of Accessibility Analysis across the Metropolitan Assembly Web sites

		AMA	KMA	STMA	TaMA
Accessibility	WCAG 1 Priority A - Issues found (disabled users will find it impossible to use some pages)	√	√	√	√
	WCAG 2 Priority A - Issues found (disabled users will find it impossible to use some pages)	√	√	√	√
	Section 508 - Issues found (disabled users will find it impossible to use some pages)	√	√	√	√

Table 6. Breakdown of Usability Analysis across the Metropolitan Assembly Web sites

		AMA	KMA	STMA	TaMA
Usability	Usability.gov Guidelines - Some pages violate these guidelines	√	√	√	√
	W3C Best Practices - Some pages are hard to use	√	√	√	√
	Readability - No issues found	√	√	√	√

Table 7. Breakdown of Compatibility Analysis Results across the Metropolitan Assembly Web sites

Some pages misbehave on …		AMA	KMA	STMA	TaMA
Compatibility	Internet Explorer	√	√	√	√
	Firefox	√	√	√	√
	Safari	√	√	√	-
	Opera	√	√	√	-
	Chrome	√	√	√	-
	iPhone/iPad	√	√	√	√
	Android	√	-	√	√
	BlackBerry	√	√	√	√

Table 6 presents the results of performing a usability analysis on all web sites. The usability test is beneficial because it enhances the site's credibility and increases the usage (Silva & Wijayaratne, 2015). Table 7 presents the results of a compatibility analysis with respect to various devices and web browsers. The compatibility test is essential in order to ensure a web site is verified to run on different browsers, various resolution, various operating systems, as well as detecting issues faced by web site using legacy features (Motwani et al., 2015).

Table 8. Breakdown of Privacy Analysis Results across the Metropolitan Assembly Web sites

		AMA	KMA	STMA	TaMA
Privacy	US CAN-SPAM Act 2003	No issues found	No issues found	No issues found	No issues found
	EU Privacy Regulations 2003 - Some pages violate these regulations	√	√	√	√

Discussions surrounding privacy and web security have been on the ascendency in recent years and as such a privacy test was of great importance. Díaz and Martín-Consuegra (2016) pointed out privacy and security as indicators of trust in a website which in turn persuade user engagement. From Table 8, it is clearly evident that all web sites were compliant with the US CAN-SPAM Act 2003 but breached EU Privacy Regulations.

Table 9. Breakdown of W3C Standards Analysis Results across the Metropolitan Assembly Web sites

		AMA	KMA	STMA	TaMA
Standards	W3C HTML/XHTML Validation - All pages valid	√	√	√	√
	W3C CSS Validation	Some pages fail validation	-	Some pages fail validation	Some pages fail validation
	W3C Deprecated Features	-	Issues found	Issues found	-

Table 10. Breakdown of Search Guideline Analysis Results across the Metropolitan Assembly Web sites

		AMA	KMA	STMA	TaMA
Search	Google Search Guidelines - Some pages may rank poorly on Google	√	√	√	√
	MSN Search Guidelines - Some pages may rank poorly on MSN Live Search	√	√	√	√
	Yahoo Search Guidelines - Some pages may rank poorly on Yahoo	√	√	√	-
	Robots.txt Guidelines	No issues found	No issues found	No issues found	No issues found
	Search Best Practices	No issues found	No issues found	No issues found	No issues found

Table 11. Result of Mobile Friendliness using Google's Mobile Friendly Test tool

	AMA	KMA	STMA	TaMA
Mobile Friendly	√	-	-	-
Issues Highlighted	-	• Text too small to read • Content wider than screen • Viewport not set • Clickable elements too close together • Uses incompatible plug-ins	• Text too small to read • Content wider than screen • Clickable elements too close together • Viewport not set • Uses incompatible plug-ins	• Text too small to read • Content wider than screen • Clickable elements too close together • Viewport not set • Uses incompatible plug-ins

Evidently, with respect to Ghana's metropolitan assembly web sites, the level of quality, privacy, and adherence to W3C standards in design and development is not encouraging as represented in Tables 3 to 10. Results of the analysis reveal that the web sites are fairly compatible to browsers but certain issues of inconsistency are likely to occur during the browsing experience (see Table 7). Instances of the use of obsolete HTML and CSS syntax are largely evident and may present issues of incompatibility as the years go on (see Table 9). As per search engine optimization, there has not been much effort placed on that aspect (see Table 10). Search engine optimization (SEO) increases traffic to web sites and gives one's website the deserved visibility regardless of the errors existing on the website (Berman & Katona, 2013). Table 11 reveals results of the mobile friendliness test and shows that only 1 out of the 4 web sites is responsive. The issues of non-mobile friendliness highlighted include: font size issues, content wider than screen, clickable elements too close together, viewport not set and the usage of incompatible plug-ins.

The issues at stake speak immensely concerning the amount of attention given to projects of such caliber – less citizen-oriented and can be seen as a clear picture of e-government as a means of establishing legitimacy to international communities (Maerz, 2016). In doing so, such web sites act as a façade which mask the real issues on the ground and exist for the sake of existence. Government web sites must well designed and engage its users because, good design supports both trust and transparency (when combined with good content) (Youngblood & Youngblood, 2017).

Discussion and Recommendations

The limitation to the study was that only a maximum of 100 web pages and images could be assessed by the SortSite software, yet still the results attained were satisfactory for the scope of this study. As reiterated by Davids et al. (2017), the use of automatic tools even though fast and convenient to detect accessibility errors, is inefficient since it is capable of detecting only up to half the errors, hence this study presents an aspect of accessibility which requires further in-depth analysis.

The study's results present a relevant contribution to academic and industry discussions on the importance of the evaluation of web sites - primarily in the area of e-government. Also, with regards to the UN sustainable development goal number ten (10), which aims at reducing inequalities, by making local government web sites also accessible to the blind and persons with visual impairments, this study contributes to theory on bridging the gap. Furthermore, practical contribution is made by including an evaluation criterion for local government and government agencies' web sites.

This study's findings reveal a gap in the usage of international web standards as a guideline in building official metropolitan (local government) web sites in Ghana. In line with assertions of Donker-Kuijer et al. (2010), non-compliance to such standards are primarily as a result of the complexities which are associated with the complexity of the government heuristics as well as the complexity of the guidelines and the possible likelihood that the heuristics aid the experts (designers and developers) in their work.

As pointed out by Yang and Chen (2015), when policymakers adhere to these web accessibility prescriptions, they can then ensure that not only are government and government-affiliated web sites, but also large private web sites, are accessible to older adults and persons with disabilities. But who will hold private firms accountable when policymakers themselves turn a blind eye to the issue at hand?

The issue of privacy and security practices in web design and development is at the heart of citizen-centric design and as pointed out by Zhang and Von Dran (2000) and Kumar et al. (2007), they are important factors to consider with respect to government-associated web sites and e-government systems.

Practically, the implications of such issues with regards to the evaluated official metropolitan assembly web sites include exposure to hacking due to the flawed nature of the metropolitan assembly web sites. Also, the design features prevent citizens from benefiting from the potentials the web sites might hold, hence less participation. Thus, as pointed out by Butt (2014), citizens should be involved in the design process. With respect to contribution to theory, the study proposes the Double Evaluation Technique (DET) as a comprehensive and exhaustive framework for web site analysis due to the complementary properties of each individual guideline made use of.

Moreover, integrating statistics for research purposes, local government e-services, platforms and forums for engaging the youth in social good, mobile friendly and interactive design, and gamification for user retention and increased citizen participation (Maciel et al., 2017) is recommended. Policy makers can also explore the potential of hosting public opinion polls on these web sites as a means of engaging residents which in turn affects socioeconomic development.

Conclusion

This study, which is the first of its kind with respect to local government web sites in Ghana, utilized automated web testing tools in assessing the level of accessibility, usability and compatibility of 4 official web sites of Ghana's metropolitan assemblies. The study also developed and proposed the Double Evaluation Technique (DET) for assessing the compliance of the selected web sites with W3C standards. At a glance, majority of the web sites reveal a lack of professionalism in design and user experience and calls for further review of design patterns and more attentiveness to web standards.

The results of the study revealed a lack in compliance with W3C standards as well as the EU Privacy and Electronic Communications Regulations 2003 and US CAN-SPAM Act 2003. The study points out the need for much more introspection concerning the design, development and publishing of local government web sites, precisely in the context of Ghanaian metropolitan assemblies. It presents the evidence that flaws in design and adherence to W3C web development standards are existent and create a bad impression for user retention and engagement, expose security defects which when breached tarnish the image of government and loss of trust by citizens in handing over personal data to government.

The authors recommend the usage of the proposed tools and methodology (Double Evaluation Technique) presented in this study as a framework for assessing and evaluating Government web sites by IT experts in government. The results of this study offer a platform for further studies which will delve into a more qualitative approach in assessing the level of usage of local government and metropolitan web sites and statistically correlate user experience to automated web testing results. Hence shedding more light on user experience flaws and the lack of technological engagement by metropolitan assemblies so as to correct the existing problems and achieve more user-centric, user-friendly, secure, compatible and accessible government web sites at all levels.

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